

## GYROSCOPICALLY STABILIZED THROWABLE IMPLEMENT

### BACKGROUND OF THE INVENTION

**[0001]** The present invention generally relates to throwing implements and more particularly relates to gyroscopically stabilized throwing implements that include a recordable disk medium such as a CD.

**[0002]** Most people are familiar with a throwable gyroscopically stabilized aerodynamically favorable implement as a toy generally known as a Frisbee™. Historically, the Frisbie Pie Company of Connecticut offered pies in a pie-tin that, once the pie was eaten, was used by Ivy-league college students as an implement to be tossed between throwers for Frisbie-ing entertainment. Others also sailed flat disks for entertainment resulting in various improvements in aerodynamics, mass distribution, materials, and additional features culminating in the Frisbee™ toy and its cousins we see today.

**[0003]** It has become commonplace for large volumes of information to be stored in digital form on a recordable disk storage medium generically called a CD. A CD, however, is more accurately described as a discoidal laminate of plastic, metallic, and/or dye having discontinuities in an optically readable (and writable) layer or layers that encode digital information according to predetermined standards. Different standards (and materials) are used to define a Compact Disk (CD) for digital audio recordings, a Video CD for digital video recordings, a Digital Video Disk (DVD) for high quality video recordings (sometimes called a Digital Versatile Disk), and CD-ROM (CD-R and CD-RW for writable storage) for storage of data.

1. The first step is to identify the problem or question that needs to be addressed. This involves understanding the context and the specific requirements of the task.

**[0012]** FIG. 7 is a cross section of an alternative embodiment of a throwable gyroscopically stabilized aerodynamic implement which may be employed in the present invention.

**[0013]** FIG. 8 is a cross section of an alternative embodiment of a throwable gyroscopically stabilized aerodynamic implement which may be employed in the present invention.

#### DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

**[0014]** A novel combination of a Frisbee™-like toy and a CD offers those who wish to distribute a CD in a surprising way just such an opportunity. It can be envisioned that a popular concert would include, as a stimulus for the concert-goers to purchase an audio CD or a DVD by the performers, a distribution from the stage of a limited number of CD-including Frisbee™s by launching the implements from the stage. The advent of rapid recording of CDs makes it possible for a recording of that very concert to be impressed upon the CD being sailed out among the audience immediately following the conclusion of the concert. Other advertising and promotional uses easily fall within the purview of the implement.

**[0015]** A mere flat disk does not have the aerodynamically advantageous shape to provide a reasonable flight experience that a Frisbee™ offers. The curved upper surface coupled with the flat lower surface and the angle of attack into a flowing airstream provide lift to enable flight for the disk. Since the Frisbee™ is launched with a spin imparted by the thrower and since most Frisbee™s are created with a significant proportion of the mass of the disk located in an annular band at the circumferential edge of the disk, a substantial amount of angular momentum is created around the axis of rotation of the disk. This angular momentum gyroscopically resists changes in the direction of the angular momentum vector along the axis of rotation and results in a long and interesting flight for the Frisbee™.

**[0016]** A conventionally manufactured flat disk (without aerodynamic shaping) 101 is used as an information storage medium (a CD) is shown in a cross section of the disk in FIG. 1. Generally, information in excess of 650Mbytes of data (740Mbytes of audio) can be stored on the CD. The most common physical implementation of a CD has a diameter,  $d_1$ , of 120mm and a thickness,  $t$ , of 1.2mm and a mounting hole 103 having a diameter,  $d_2$ , of 15mm. The top

surface 105 is generally available for message and image printing while the bottom surface 107 is typically optically transparent and allows laser reading (and writing) of information from an internal lamina via this surface. Also widely available is a MiniCD, which is often encoded with digital audio - and often in MP3 format. Such a MiniCD is physically smaller (a disk diameter,  $d_1$ , of 70mm) with a correspondingly smaller information storage capacity (160Mbytes of audio or 140Mbytes of data). Non-discoidal CD shapes have been introduced, for example the credit card size and shape depicted in the plan view of FIG. 2, but the information stored is typically limited to the complete data tracks 201 between the lead in track 203 and the card edge 205.

**[0017]** A top plan view of a preferred embodiment of a gyroscopically stabilized throwable implement employing the present invention is shown in FIG. 3. The implement 301 of the preferred embodiment, casually referred to as a Frisbee™, employs a plastic body shaped in the form of a disk. Of course, other shapes offering a stable angular momentum vector through the body may also be used provided that the angular momentum and the lift of the implement are arranged for stable flight. In addition to the aerodynamic turbulence ridges 303 circumferentially molded into the convex top surface 305, a depression 307 is molded into the crown of the body. Many, if not all, of the turbulence ridges 303 and the depression 307 are concentric among themselves and with the center of rotation (the center of the angular momentum vector) of the body. In a preferred embodiment where the CD 101 is a standard size discoid, the depression 307 is circular. When other shapes for the CD are to be specially accommodated, the shape of the depression can be molded to match. Also centered on the axis of rotation is a securing mechanism for the CD. In a preferred embodiment, twelve flexible fingers 309 are arranged in a circle about the axis of rotation and protrude away from the bottom of the depression. The circle defined by the outer surface of the flexible fingers is slightly larger than the diameter of the mounting hole 103 of the CD 101 such that an interference fit with the CD mounting hole is realized. The arrangement between the components can be appreciated from FIG. 4, a cross section of the implement taken at 4 - 4.

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**[0018]** The concave under surface 401 and the circumferential distribution of mass 403 of the body can be apprehended from the cross section illustrated in FIG. 4. In order to provide compliance in the spring fingers 307, the protruding portion of the fingers are mounted on cantilevers that are attached to the flat bottom 405 of the depression in a circle 311 centered on the axis of rotation 407 and concentric with the fingers' circle but having a larger radius. Refer to FIG. 5A for a detailed sectional illustration of the spring finger assembly. The diameter of the depression 307 in a preferred embodiment is slightly larger than the diameter of a CD so that the CD 101 can be relatively easily inserted and removed from the body 301. The ease of insertion and removal must be balanced against the forces expected during flight and landing of the implement, which can be violent on a small scale.

**[0019]** The easiest insertion and removal is realized by forming the spring fingers and the depression as shown in FIG. 5A. One spring finger 309 is magnified and shown in cross section. The portion of the spring finger that contacts the hole of CD 101 is a portion 501 that protrudes essentially perpendicularly away from the bottom surface 405 of the depression 307 and offers frictional contact with the hole of the CD 101 to maintain the CD in place and clearing the peripheral walls of the depression by a distance,  $c$ , of 1.6mm. The fingers are disposed at the distal end of a cantilever portion 503 that is, in the preferred embodiment, elevated parallel to the bottom surface 405 at a spacing,  $b$ , of 1.2mm and bonded to the bottom surface 405 of the depression 307 by an attachment portion disposed at the proximal end of the cantilever in a circular ring having a larger diameter than the circle formed by the protruding portion of the spring fingers, at 505. The length of the cantilever, from the CD-contacting surface of the protruding portion of the spring finger to the point of bonding in a preferred embodiment is 4.0mm. The thickness,  $m$ , of the plastic material forming the spring finger is 0.8mm. In order to aid the removal of the CD, the spring finger is bent into a crooked portion 507 directed toward the axis of rotation (not illustrated in FIG. 5A), disposed parallel to the bottom surface 405 of the depression 307, and elevated by a distance,  $h$ , of 3.2mm from the bottom surface. Removal of the CD is accomplished by placing a human finger

or stylus at the tip of the crooked portion 507 of the spring fingers and pushing toward the bottom surface 405. This pressure causes the cantilever portion 503 to deflect a sufficient amount that the frictional force supplied by the protruding portion of the finger against the CD is released. The CD may then be pulled out of the depression 307.

**[0020]** When increased protection is needed to prevent the CD from being dislodged from the implement body during a collision of the implement and an object in the flight path, a ridge 509 is added to the spring fingers 309 at the junction of the protruding portion 501 and the crooked portion 507 as illustrated in FIG. 5B. This ridge 509 extends beyond the CD-contacting surface of the spring finger 309 protruding portion 501 by a distance,  $f$ , of 0.8mm. The ridge makes the insertion and removal of the CD more difficult for the human but also makes the inadvertent dislodgement more unlikely. Yet another technique of securing the CD into the body is illustrated in FIG. 5C. The outer edge of the CD is captured by a lip 511 that defines the periphery of the depression. In this embodiment, the depression is formed with a diameter that is only slightly (1.6mm in the alternative embodiment) larger in diameter than the CD. The lip 511 extends beyond the essentially flat sidewall 513 of the depression 307 by a distance,  $g$ , of 1.6mm, thereby capturing the CD edge. The lip need not be continuous around the periphery but should capture the CD in at least two places. Insertion and removal of the CD is difficult, requiring the body of the implement to be flexed at the same time the spring fingers are depressed. However, the likelihood of the CD being dislodged is diminished considerably.

**[0021]** An alternative embodiment that replaces the depression with a through-hole 601 in the body 301 from the top surface 305 to the under surface 401 is illustrated in the cross section of FIG. 6. The through-hole has at least two edges, and as much as a complete periphery, that is approximately the same diameter as the CD and has an indented lip pair 603 that has a separation between each lip of 1.0mm, less than the thickness of the CD and an overlap of the CD, for a full capture of the CD edge, of 1.6mm.

**[0022]** An alternative embodiment in which the CD 101 is attached to the under surface 401 of the body 301 is illustrated in the cross section of FIG. 7.

FIG. 5C

The top surface 305 and crown of the body can be maintained without change from a conventional Frisbee™ and include advertisement or other adornment in the discretion of the designer. Spring fingers 309' protrude away essentially perpendicularly from the under surface 401 to frictionally capture the CD at its through hole, as described above. Also as described above, the spring fingers are affixed to the surface of the body, albeit in this embodiment to the under surface 401, by way of a cantilever portion and are arranged in a circle having a center coincident with the center of rotation 407 of the implement. Although this embodiment offers increased physical protection to the CD, its presence is not as readily observed and any advertisement or promotional material that is present on a surface of the CD is not as prominent. In order to compensate for this hiddenness, the body of the implement can be formed of a transparent plastic, either in whole or just in an area near the crown of the body.

**[0023]** Another embodiment of the present invention is illustrated in the cross section of FIG. 8. A depression 307 is formed in the top surface 305 of the body 301, having an essentially flat bottom surface 405 and a shape and depth to accommodate the expected CD 101. A pedestal 801 is disposed on the bottom surface 405 and arranged symmetrically about the axis of rotation 407. For those instances where the pedestal is circular, the diameter of the pedestal is approximately 30mm to contact the CD within the clamping area, and the height of the pedestal is 1.2mm to prevent the surface of the CD from generally contacting the bottom surface 405 of the body. A paper or plastic tape 803 is disposed over the CD 101 and the depression 307 and extends for an overlap distance 805 on the upper surface 305 of the body. In a preferred embodiment, this paper or plastic tape is selectively coated on its inner side with an adhesive in the overlap distance 805 and in the contact ring area 807 such that the CD is secured and protected within the depression 307. Advertisement and promotional material can be printed or disposed on the outer side of the paper or plastic tape.

**[0024]** Thus, a CD is disposed with a Frisbee™-like implement for packaging and distribution of the CD. The gyroscopic stability of the implement is not

